

Appln No. 10/090,915

Amdt date August 3, 2004

Reply to Office action of May 4, 2004

as the unexpected results achieved by the combination of ethylene glycol and isopropanol in the etching solution claimed in this application. The Examiner agreed that the unexpected results achieved in this application would overcome any obviousness rejections under 35 U.S.C. § 103(a), but requested specific evidence of those unexpected results. Accordingly, applicant hereby provides the requested evidence.

In the specification at page 2, lines 4-5, an etching solution prepared using ethylene glycol is described as achieving pyramids sized less than or equal to 2 μm . However, etching solutions using ethylene glycol are noted in the specification at page 2, lines 5-7, not to be immediately useable because they require a preceding dissolution of silicon.

At page 2, lines 20-21, an etching solution prepared using isopropanol is described as achieving undesirably large pyramids. However, etching solutions using isopropanol are noted in the specification at page 2, lines 15-16, to be immediately useable for texture etching.

In contrast, the present application claims an etching solution that creates sufficiently small pyramids and that is immediately useable. Such an etching solution is extremely valuable in the creation of solar cells. The small pyramids ensure good electrical quality of the solar cell by providing reproducible pyramid structures and enabling uniform structuring of the entire etching surface. In addition, providing a solution that is immediately useable dramatically reduces the cost of production.

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The present application describes several exemplary embodiments of an etching solution using a combination of ethylene glycol and isopropanol. (Specification page 5, line 6 through page 6, line 6). One solution uses an isopropanol to ethylene glycol volume ratio of 40:1 and achieves a pyramid height of approximately 6 μm . (Specification page 5, lines 6-14). Another solution uses an isopropanol to ethylene glycol volume ratio of 10:1 and achieves a pyramid height of approximately 3 μm . (Specification page 5, lines 15-21). A third solution uses an isopropanol to ethylene glycol volume ratio of 2:1 and achieves a pyramid height of less than 1.5 μm . (Specification page 5, lines 22-28). A fourth solution uses an isopropanol to ethylene glycol volume ratio of 16:1 and achieves a pyramid height of less than 1.5 μm . (Specification page 6, lines 1-6). Each of these solutions is immediately useable. (Specification page 6, lines 12-15).

The exemplary solutions achieve pyramid heights similar to the heights achieved by a solely ethylene glycol solution. However, the solutions are also immediately useable, a property normally attributable to purely isopropanol solutions. The combination of small pyramids, normally achievable only with a solely ethylene glycol solution, with the ability to immediately use the solution, normally achievable only with a solely isopropanol solution, produces solar cells with reproducible pyramids and uniform etching surfaces. In addition, this combination drastically reduces the cost of producing such solar cells, as the preceding dissolution of silicon is no longer necessary.

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Neither Bailey nor Uchimura teaches or suggests that these characteristics can be achieved by combining ethylene glycol with isopropanol in the etching solution. The Examiner relies on Uchimura to suggest that ethylene glycol and isopropanol are functionally equivalent. However, the alcohols used in Uchimura for a completely different purpose, namely esterification. Accordingly, applicant respectfully submits that the combination of ethylene glycol and isopropanol produces unexpected and desirable results sufficient to overcome the Examiner's obviousness rejections.

In view of the above remarks, applicant respectfully submits that all of pending claims 1-12 are in condition for allowance. Applicant therefore respectfully requests a timely indication of allowance. If there are any remaining issues that can be addressed by telephone, applicant invites the Examiner to contact the undersigned at the number indicated below.

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By 

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626/795-9900

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